

SPECIAL FORECASTS AND WARNINGS—WEATHER AND CROPS.

WEATHER WARNINGS.

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STORM WARNINGS.

On the morning of January 1 there was a disturbance of marked intensity over the upper St. Lawrence Valley, moving northeastward, so at 12 noon NW. storm warnings were ordered along the Atlantic coast from the Virginia Capes to Eastport, Me. However, a lagging behind of the western section of the low pressure area lessened the storm intensity, and, except between New York City and Block Island, R. I., there were no strong winds until during the night of the 2d–3d, when there were moderate westerly gales between Cape Henry, Va., and Block Island.

On the morning of the 6th a moderate disturbance was developing off the western coast of the Gulf of Mexico, with an extensive and marked high pressure area to the eastward, so at 10:30 a. m., SE. storm warnings were ordered along the east Gulf coast from Bay St. Louis, Miss., to Carrabelle, Fla., strong E. and SE. winds being forecast for the day and night of the 6th. Strong SE. winds occurred as forecast.

On the evening of the 7th a southern plateau LOW was central over the mouth of the Rio Grande, with a northeastward movement, so at 10:30 p. m. SE. storm warnings were again ordered from Bay St. Louis to Carrabelle. Moderately strong winds followed.

By the morning of the 9th the center of the disturbance had reached the upper Ohio Valley with increased intensity, and at 3 p. m. warnings were ordered along the Atlantic coast from Point Judith, R. I., to Provincetown, Mass., for strong NE. to NW. winds at night and NW. on the following day. Moderately strong NE. winds followed, and the warnings were lowered on the morning of the 10th. On the morning of the 12th a LOW from the far NW. was over Manitoba in marked form, so at 10 a. m. warnings were sent to open ports on Lake Michigan for strong SW. to W. winds with snow and rain, shifting to NW. on the 13th. This warning was fully justified. By the evening of the 12th the center of the disturbance was over northern Lake Superior with undiminished intensity, and at 10:30 p. m. SW. storm warnings were ordered along the Atlantic coast from Delaware Breakwater, Del., to Bangor, Me., for strong SW. winds with snow by the following evening. Strong winds followed, except along the northern New England coast. At 11 a. m. of the 13th, with the storm center over western Ontario, and with rapidly rising pressure to the westward, the SW. warnings were extended southward to Norfolk, Va. Moderately strong NW. winds occurred on the following day. At 10:30 p. m. the warnings from Delaware Breakwater to Newburyport, Mass., were changed to NW., and NW. gales were general on the 14th, New York City reporting a maximum wind velocity of 74 mi. hr. from the NW. The warnings south of Delaware Breakwater were also changed to NW. at 11 a. m. of the 14th, and at 10:30 p. m. they were continued where displayed to the northward. The strong winds continued during the 15th along the northern New Jersey and southern New England coasts.

On the evening of the 16th another disturbance from the NW. was central over northeastern Ohio, with a more moderate secondary center over the Virginia

Capes, and at 10 p. m. storm warnings were ordered along the New England coast from Point Judith, R. I., to Eastport, Me., strong NE. winds with snow being forecast for the following day upon the assumption that the secondary disturbance over the Virginia Capes would move rapidly northeastward with rapidly increasing intensity. By the following morning the secondary disturbance was near Nantucket with a barometer reading of 29.30 inches, while the primary disturbance was over northern New York. Snows and gales and rains occurred as forecast, and the westerly winds did not finally subside until the night of the 18th–19th.

On the evening of the 20th a disturbance from Utah and Colorado was over eastern Lake Erie, so at 10:30 p. m. warnings were ordered from Delaware Breakwater to Portland, Me., for strong S. and SW. winds on the following day, to shift to NW. by afternoon. As the disturbance did not develop further during its northeastward progress, nothing more than fresh winds occurred along the coast.

On the morning of the 23d abnormally high pressure, with low temperatures over the northern portion of the country, with a moderate LOW over northeastern Arkansas, indicated the approach of strong NE. winds with snow over the Lake region, so at 10 a. m. advisory warnings to that effect were sent to open ports on Lake Michigan. Subsequent conditions were in accord with the warning.

On the morning of the 24th there was a moderate LOW over southwestern Virginia, with continued abnormally high pressure to the northward, and therefore at 11 a. m. NE. storm warnings were ordered along the New England coast from Point Judith, R. I., to Newburyport, Mass., and strong NE. winds and snow occurred as forecast. On the following morning there was a still more moderate LOW over the eastern portion of the Gulf of Mexico, with persistent high pressure to the northward and northeastward, and at 10:30 a. m. NE. storm warnings were ordered along the Atlantic coast from Fort Monroe, Va., to Jacksonville, Fla. This warning was also generally verified.

On the morning of the 26th there was a well-defined LOW over northwestern Minnesota, with a rapid eastward movement, and with high pressure on either side, so advisory warnings were sent to open ports on Lake Michigan for fresh S. and SW. winds, shifting to strong NW. with snow. Subsequent conditions were in accord with the forecast.

During the 29th and 30th there was a great and very rapid rise in pressure over the Northwest, following a moderate LOW that had moved fast across Canada, and at 10 p. m. of the 30th NW. storm warnings were ordered along the Atlantic coast from Provincetown, Mass., to Sandy Hook, N. J. At 10 a. m. of the 31st, with a great high area over Canada, NE. warnings were ordered south of Sandy Hook as far as Morehead City, N. C. These warnings were verified.

COLD-WAVE AND FROST WARNINGS.

On the morning of the 1st, cold-wave warnings were ordered for portions of New England, the Middle and South Atlantic States, east Tennessee and the Upper

Ohio Valley, and warnings of frost as far south as northwestern Florida. These warnings were fully verified on the following morning, freezing temperatures having been reported to the Gulf coast.

On the morning of the 2d, with high pressure and low temperatures continuing to the westward, warnings of frost, or freezing temperature, were repeated to the Southern States as far south as central Florida. These warnings were also fully verified. Some additional warnings were issued on the morning of the 3d, the limit of prospective frost being extended to southern Florida, and on the following morning frost occurred as far south as Miami, Fla. Another morning of frost was then forecast, and more frosts were reported on the morning of the 5th. Interior frosts on the morning of the 6th as far south as the 25th parallel of latitude were then forecast with success.

Special 1 p. m. observations on the 8th indicated the further development and movement of a disturbance then over Mississippi, with rapidly rising pressure to the northwestward; so at 3 p. m. cold-wave warnings were issued for temperatures near or below the freezing point for central and southern Mississippi, and at 10 p. m. for Alabama, extreme northwest Florida and central and eastern Tennessee. The warnings were repeated on the morning of the 9th, and extended to the interior of the South Atlantic States, except Florida, to the upper Ohio Valley, southern Virginia and northwestern New England. These warnings were generally verified, although the cold wave was somewhat delayed, and in some localities the required minimum temperatures were not reached.

On the morning of the 10th general frost, or freezing temperature, warnings were sent throughout the east Gulf States and the South Atlantic States as far south as northern Florida, and they were verified on the following morning, conditions occurring as forecast, except over northern Florida, where some cloudiness prevailed.

No warnings were issued for the moderate cold wave over the Lake region on the morning of the 14th, although colder weather had been forecast.

On the morning of the 17th cold weather with high pressure covered the Northwest, following the marked disturbance over the northeast, and local cold-wave warnings were ordered for the latter section, and frosts forecast for northern and central Florida, as the low pressure extended southward along the entire Atlantic coast. The cold-wave warnings were only partially justified, and there were no frosts on the following morning. Freezing temperature forecasts for the morning of the 19th over the Southeast also failed of verification owing to the rapid eastward movement of another disturbance from the west.

On the evening of the 20th a cold high area was closely following a disturbance over western New York, and warnings of a cold wave in about 48 hours were ordered at 10 p. m. for southern Ohio, West Virginia, and southwestern Pennsylvania. This warning also failed technically, although there was a marked fall in temperature.

On the morning of the 21st cold-wave warnings were ordered for northwestern New England, the interior of eastern New York, northeastern Pennsylvania, central and eastern Tennessee, southeastern Kentucky, northwestern Alabama, and northeastern Mississippi. The cold waves occurred as forecast in the northeast but failed in the South on account of the persistence of a trough of moderately low pressure over that section, a decided fall in temperature not occurring until the 24th.

Local cold waves that occurred on the morning of the 24th over northern New England, the central and southwestern portions of eastern New York, and over northeastern Pennsylvania were forecast, as was also the decided fall in temperature in the South, but the local cold waves in Michigan were not forecast beyond a prediction of colder weather.

Cold-wave warnings issued on the morning of the 25th for the South were not verified, low pressure persisting over the eastern portion of the Gulf of Mexico.

On the morning of the 26th cold waves were forecast by the night of the 27th for Upper Michigan, and temperatures below zero from 4° to 16° F. were reported on the morning of the 28th. The local cold waves on the morning of the 28th over Lower Michigan, and those of the 28th-29th over interior New York and northern New England were forecast, the cold wave extending by the morning of the 29th over southern New England which had not been covered by the warnings beyond a forecast of colder weather.

Cold-wave warnings issued on the night of the 29th-30th for Michigan, and on the morning of the 30th for northern New York and northern New England, were followed by a severe cold wave on the 31st, but the warnings were far from being sufficient, as the cold wave extended throughout the Middle Atlantic States and New England.

ICE-STORM WARNINGS.

On the morning of Thursday, January 22, pressure distribution was highly favorable for the occurrence of sleet, or ice storms, over the Ohio Valley and Tennessee. A narrow trough of relatively low pressure extended from Louisiana to east Tennessee, with marked cold and high pressure to the northward, and somewhat less marked high pressure to the southeastward, with abnormally high temperatures. The morning forecasts for the 22d stated that rain or ice storms were probable Thursday night or Friday in the Ohio Valley and Tennessee, and they occurred as forecast, the limits of ice formation extending eastward in less pronounced form into central Pennsylvania and the mountain districts of the Virginias and the Carolinas.

From press comments received it appears that this forecast was of enormous value to the transportation, telegraph, telephone, and lighting companies.

The conditions essential to the occurrence of sleet or ice storms and heavy snowstorms are nearly identical, except as to the temperature distribution over the southern regions covered by the high pressure. If the temperatures in this section are abnormally high there will be (1) an overrunning of a mass of abnormally warm air from the southern high pressure high area, with its large moisture content; (2) the precipitation of this moisture in the form of rain when it reaches and rises over the cold counter current on the north side; and (3) the freezing of this rain before or when it reaches the surface. If the temperatures in the southern high area are low, or even normal, the precipitation to the northward will usually be in the form of heavy snow.

HEAVY-SNOW WARNINGS.

Warnings of heavy snow issued on the 23d for southern Lower Michigan, the extreme northern portions of Indiana, Ohio, and western Pennsylvania, and for western New York, were generally verified, as were those of the 24th for New England.

Chicago Forecast District.—No warnings were issued during the first half of January, except that advices of much colder weather with snow and fresh northerly winds were sent to the stock interests of Kansas, Nebraska, and Wyoming on the 6th. Cold waves without warnings occurred in northern Wyoming and at Billings, Mont., on the 7th, and at one or two stations in northern Minnesota or northern Wisconsin on the 8th, 9th, 13th, and 14th.

On the 16th cold-wave warnings were issued for eastern Montana, northeastern Wyoming, and the extreme western portions of the Dakotas, and cattle warnings for South Dakota, Wyoming, and western Nebraska. These warnings were not verified, except in northeastern Montana and extreme western North Dakota. A cold wave without warning occurred at Duluth, Minn., on the 17th. Cold-wave warnings were issued for portions of Montana, Wyoming, and the Dakotas on the 18th and 19th. On the 20th the warnings were extended to cover Kansas, Missouri, extreme eastern Nebraska, and portions of Iowa, Minnesota, and Wisconsin. The warnings of the 18th and 19th were partially verified, and those of the 20th were fully verified except in southern Missouri.

The next warnings were issued on the morning of the 23d for western and central Iowa, the eastern portions of Nebraska and Kansas, and limited areas in Minnesota, Missouri and Wyoming, and they failed of verification, although the sea-level pressure had increased to 31 inches over the northeastern slope of the Rockies. On the 24th cold-wave warnings were issued for extreme eastern Minnesota and central Iowa and were verified in the latter section only.

During the 25-26th a disturbance of considerable energy moved rapidly eastward over the northern tier of States and was followed by a decided increase in pressure and a cold wave as far east as Wisconsin and north-central Iowa. Warnings were issued for the entire area affected.—*Chas. L. Mitchell.*

Denver Forecast District.—The month opened with a continuation of the high-pressure conditions in the Plateau region and on the western slope that prevailed in December. A southwestern disturbance overspread the district, however, early in the first decade. It was attended by remarkably heavy rains in parts of Arizona. At Yuma the rainfall for the 36 hours, ending 8 p. m. January 4th was 1.26 inches, or about three times the monthly normal. On the morning of the 7th the center of the disturbance was in southwest Colorado, while abnormally high pressure had overspread the middle and north Pacific States and the eastern slope. A warning of a moderate cold wave was issued for parts of Utah, Colorado, and New Mexico. The 24-hour fall in temperature was not sufficient to verify the warnings, but much lower temperatures followed within 48 hours. The following low readings were reported: Modena, 8° below zero (F.); Durango, 8° below (F.); Grand Junction, 12° below (F.); and Gallup, 2° below (F.). High pressure became reestablished west of the mountains by the 9th and this condition continued until the 20th. A southwestern low formed on that date and dominated the weather in the greater part of the district until the 24th, when the barometric pressure again built up on the

western slope and continued during the remainder of the month. No warnings were issued after the 7th, except for parts of eastern Colorado. A moderate cold-wave warning was issued for the extreme northeast portion of northeast Colorado on the morning of the 17th and again on the evening of the 19th. The warning of the 17th failed of verification, owing to the rapid eastward movement of the high. The warning of the 19th was fully verified. A moderate cold-wave warning was issued for eastern Colorado on the morning of the 20th, as high barometric conditions had overspread the northeastern slope. The warning was followed by a sharp fall in temperature in eastern Colorado, with verifying temperatures except near the foothills.—*Frederick W. Brist.*

New Orleans Forecast District.—Cold-wave warnings were issued at 3:30 p. m. January 7, for Arkansas and the northern portion of east Texas, and extended at 10 p. m. to the southwestern portion of east Texas, and on the 8th at 10 a. m. for Port Arthur, Tex., and on the 9th at 10 a. m. for southern Louisiana. The temperatures recorded and the fall in temperature justified the warnings except at a few stations.

Cold-wave warnings were issued January 20 at 10 a. m. for Oklahoma and the extreme northwestern portion of Arkansas; they were extended at 10:25 p. m. over the remainder of Arkansas, northwestern Louisiana, and the northern portion of east Texas except the extreme west portion, and on the morning of the 21st were extended over southern Texas and continued over northwestern Louisiana. There was a decided fall in temperature which justified the warnings.

Cold-wave warnings were issued January 23, 10:30 p. m., for Arkansas, Louisiana, and the southern portion of east Texas, and were repeated on the 24th at 10 a. m. for Louisiana and Port Arthur and Galveston. The warnings were justified over only a portion of the area. No cold wave occurred without warning.

Storm warnings were ordered displayed on the Texas and Louisiana coasts on January 5 and 6, and on the Texas coast on the 7th. Verifying winds occurred at a few stations during the displays. No general storm occurred without warning.

Low-temperature warnings were issued for live stock and other interests on January 20, 21, 23, and 24, for considerable portions of the district.

Fire-weather warnings were issued January 5, 7, and 8, —*I. M. Cline.*

San Francisco Forecast District.—Quite cold weather prevailed during the latter part of the first and early part of the second decades. Frequent heavy to killing frosts occurred in California during this period and frost warnings were issued daily. During this cold spell some citrus fruit was injured in the upper San Joaquin Valley.

Small-craft warnings were ordered at the Strait of Fuca on the 2d and 3d, and at the mouth of the Columbia River and at Washington stations on the 29th. NW. storm warnings were ordered from Port Harford to San Diego on the 3d; NE. storm warnings from Eureka to San Francisco on the 7th; SW. storm warnings at the mouth of the Columbia River and Washington stations on the 17th, 18th, and 24th; and SE. storm warnings at the same stations on the 27th.—*G. H. Willson.*